THE VALUE OF ISOLATION
IN CONTROLLING
THE SPREAD OF PNEUMONIA.

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In the effort to prevent the spread of contagious diseases man always has, and probably always will resort to some method of separating the sick from the well. Whatever term be applied to the measure, whether it be quarantine, isolation or segregation, the effect is much the same, the term used signifying to a great extent the degree of enforcement. As a matter of fact the word isolation has become a general term in Preventive Medicine to cover any process which prevents the unnecessary association of healthy and sick individuals. In reality it is a modified quarantine, applied to one or a few persons. The word "Quarantine" is derived from the Italian "Quarante" meaning forty, and was first used in connection with holding supposedly infected vessels in port for forty days, before allowing discharge of passengers or cargo. This measure was applied during the 14th Century, and represents one of the first systematic efforts used against the spread of contagious disease.

Quarantine carries with it a more or less rigid governmental enforcement, and being therefore somewhat of a drastic measure it became more closely associated with the severer infections, while the methods used against the milder diseases were modified in proportion as the danger of the contagion diminished. In addition to the natural desire of the Public for less stringent measures in the attempt to control the spread of disease, there were many other factors which influenced the modifying

of quarantine, such as demands of commerce, and medical progress in discovering the causes of disease and the modes of transmission. As a result of these influences the almost impassable barrier erected by the older methods of quarantine became much less formidable, and numerous but well guarded entrances and exits replaced the former solid wall. Today in this country at least, the term is practically limited to Federal activities with regard to vessels in Port, and to Interstate traffic. As applied to persons the word formerly meant detention or isolation because of some disease with outward manifestations rendering it more or less loathsome, such as smallpox, and perhaps for this reason as much as any other the word is little used in modern times, and isolation has come to be the accepted term.

Strictly applied isolation means the separation of a sick person from the Public, and also from his friends and relatives. This procedure will usually prove disagreable to the official seeking to enforce it, but more so to the victims, and in most cases will work a hardship on the patient and his family. It effects the finances if the wage earner is confined; it means absence from school where children are detained, and it is to say the least an inconvenience to all concerned.

There is probably no phase of Public Health work which presents more difficulties to the conscientious official, than does isolation, and as a rule there is little satisfaction for him, even if his mandates are carefully carried out. The

disease seems to spread in spite of his efforts, and the laity as well as the profession, is inclined to be pessimistic and to point to other communities where the same measures are not in force, and the disease has attacked perhaps even a smaller percentage of the population. Such observations together with recent advances in Medical Science showing the prominent role played by carriers and mild unrecognized cases, and the paucity of definite working facts regarding immunity and susceptibility, have led the practioner to take various stands in the matter of isolation; some declaring that it is practically a useless measure and a waste of time and effort, while others still advocate the rigid confining of all infectious cases and contacts, with thorough disinfection of persons and premises after the symptoms have disappeared.

To speak then of isolation in connection with a disease like pneumonia, hitherto not so affected, and reportable in but few localities, is perhaps adding further burdens to the already overworked Public Health Official, and increasing the worries of a people which some would say are even now suffering from too much isolation. In view however of the fact that pneumonia has recently assumed a more serious aspect as a leading member of the epidemic respiratory group, and to the further fact that statistics have shown, that it is not as previously thought confined for the most part to the extremes of life, a few observations upon the advisability of employing isolation as a means for controlling its spread should not be amiss. It is believed further that the conclusions we reach will not

prove impracticable, nor be beyond the reach of a first class efficient Health Department.

In the application of preventive measures to the spread of disease, any action taken must have some definite objective purpose, open and above board, and easily explained to the lay mind. Broadly speaking, our efforts to control a communicable disease may be centred on attacking the causative organism, or removing the opportunity for transmission, or immunizing the unprotected population.

Our success in limiting the spread of any infection where the exciting cause and the mode of transmission are known, depends almost entirely upon the part played by human carriers. The more dependent the spread is upon the latter, the more difficult will be the control. Where the human element plays a small part in the transmission, the problem is simplified as there is more opportunity to attack the micro-organism in its indirect passage to the next victim,e.g. Yellow Fever. As soon as the human carrier enters even though the passage be indirect, the control becomes less efficient as in Malaria and Typhoid Fever. In the latter disease we attack the exciting cause by disinfecting the water supply, and properly disposing of human discharges; we further attempt where possible to immunize the susceptible by vaccination. Due however to our inability to apply approved measures to the entire population, we are unable to reach one hundred percent effectiveness in any of the three phases mentioned above, and the disease remains.

It is quite evident that complete success in any one of the methods of attack mentioned, would mean the elimination of a disease. For example Yellow Fever is now almost extinct, due to destruction of its mosquito carrier; Smallpox is comparatively rare where vaccination is generally enforced; Malaria, Typhoid, Diphtheria and many others have been reduced in proportion to the success attained in one or more of these lines of attack. During the late war the usual scourges of the battlefield were held in check by reducing the means of transmission and by immunization, but the respiratory infections, which presumably are conveyed directly from person to person, found the close contact of war conditions entirely favorable, and swept over the entire world.

In practically every disease in which preventive measures have gained headway in control, there has been more or less definite knowledge of the cause and the means of dissemination. Furthermore in these same infections, the main avenue of transmission is indirectly from one person to another,i.e. by means of a secondary host or contaminated material. The Public Health Official has here an opportunity to break the connecting chain at more than one point, and has also the advantage of dealing not with humans so much as with inanimate bodies,or lower forms of life.

In the case of Pneumonia the cause is not so definitely fixed as in the diseases already mentioned. We know of course

that the pneumococcus will produce the disease, so also will the Influenza Bacillus and the Hemolytic Streptococci. It has been shown experimentally by Olitsky and Gates(1), that the filterable virus with which they worked, and called"Bacterium pneumocintes", will upon injection if followed by any of the above mentioned micro-organisms, produce a typical pneumonia. The infections resulting are quite similar in clinical manifestations and pathology. Furthermore, the micro-organisms concerned in these three leading causes of pneumonia,are subdivided into groups or strains, which have various immunilogical and serological differences, as well as gradations of virulence for man and resistance to external influences. It is quite evident then that pneumonia, in so far as cause is concerned, lacks the specificity of the usual communicable diseases, and hence does not lend itself easily to attack in this quarter by preventive measures.

As to mode of transmission we are still much in the dark, and can only say that presumably the route is directly from the respiratory tract of a patient or carrier to that of a contact by spray in the act of talking, coughing or sneezing, or indirectly by hand to mouth and using contaminated articles. However there is as yet no confirmatory evidence of these paths being the ones employed, and there is some experimental work which throws considerable doubt upon such transmission. Cecil and Blake(2) found that large amounts of pneumococcus culture

inoculated into the nose and throat of a monkey failed to produce pneumonia, while minute amounts by intratracheal injection caused a pneumonia clinically identical with that in man. In a a further study (3) they found that when a virulent Influenza Bacillus was inoculated into the nose and throat of a monkey, there resulted a severe inflammation of the respiratory tract and accessory sinuses, followed or accompanied by an influenzal pneumonia similar to that in man. Major H.J.Nichols M.C.(4) using Hemolytic Streptococci as test organisms and humans as subjects, found that infection of the mouth did not occur when the micro-organisms were smeared on the lips, that they were present in insignificant numbers on the fingers of carriers, but that they survived for several hours in droplets, and in the air of Streptococcus wards after patients had been removed.

Stillman (5) collected sixty-two specimens of dust from rooms not occupied by pneumonia patients, and recovered pneumococci from 29% of the samples; the dust from rooms in which cases were present produced pneumococci in 40%, and the types found corresponded with those of the patients. It would seem from these findings that inhalation of dust might play a prominent part in conveying the infection from person to person.

The past four years have seen an enormous amount of experimentation, in the endeavor to settle definitely the method of spread in pneumonia and the other respiratory diseases especially Influenza. Brilliant results by one worker fail to materialize in the laboratory of another, and the field is still

open for investigation. However from the mass of data available there is evidence, that a filterable virus present in the sputum of infected cases, plays an important part in lowering the resistance of the lung tissue to invasion by many pneumonia producing organisms. Furthermore the spread of the virus as well as the bacteria is no doubt principally by means of droplets expelled while coughing, sneezing, spitting and talking. The spray thus thrown into the air may fall to the floor and contaminate the dust, or may be inhaled directly by a person nearby, who is then in danger of becoming a victim to the disease or a carrier. Presuming then that the cause of pneumonia gains entrance to the next individual by the inhalation of dust or infected droplets, it is quite apparent that outside of isolating the person who contaminates the surrounding air with his sputum, there is little the Health Officer can do to control the spread of the disease.

So far in our study we have reached no firm ground upon which to make a stand, in combating the causative organism of pneumonia, or in limiting its dissemination. The third method of attack, immunization, offers as yet little hope, but does hold out some promise of future possibilities.

It has long been considered that pneumonia confers no active immunity or at best for a short period only, in fact it is generally accepted by the Profession that an attack renders the patient more susceptible to further invasions. While very little experimental evidence is at hand to refute this

there is some proof that the disease does confer immunity at least for a while. Dochez (6) 191. showed that the serum of pneumonia convalescents usually contained protective substances against their homologous strains, and Flake in 1918 (7) found precipitates in the serum of recovered cases. Cecil and Flake 1920 (8) inoculated monkeys two weeks after complete recovery with much larger doses of culture than had caused their attack and found that they were protected.

Active immunization of laboratory animals has been successful for many years, but similar methods applied to man did not produce satisfactory results, until the work of Neufeld and Haendel,1910 (9), confirmed by Dochez and Gillespie 1913 (10) showed that serologically there were various types of pneumococci.

In 1911 and 1912 ,Wright (11) vaccinated 17,000 men in the Premier mines So.Africa against pneumonia, and reported a death rate of only 6.89 per thousand cases among the vaccinated, while the unvaccinated had a rate of 17.72. The same experiment conducted in the Rand mines showed little difference in rates between the test cases and controls. This work however was previous to the discovery that different types existed, and in 1917, Lister (12) initiated vaccinations guided by the new work and found a marked degree of protection was obtained against the specific type from which the vaccine was prepared.

During 1917 and 1918 vaccination was carried out on a large scale in the United States Army, but owing to the exigencies of the service and the epidemic of Influenza, definite conclusions

could not be reached, though there was sufficient evidence of good results to justify the Surgeon General in directing that continued efforts be made along this line. During the season of 1920-21, while there was little pneumonia in the Army, it is noted (13) that the incidence of the disease among the vaccinated was decidedly lower than among the unprotected,

These findings while insufficient to form definite and final conclusions, indicate nevertheless that it is possible to produce immunity, at least against a given type. There are still some formidable obstacles to surmount, such as producing a polyvalent vaccine effective against all types of pneumonia, and secondly, being able to apply the prophylactic measure to the general public. Like Typhoid vaccination, it will probably be confined to military and naval bodies and perhaps to some large working forces, where the step can be made obligatory.

The control then of pneumonia spread, promises little success to date, in attacking the micro-organism, or interrupting the passage to the next victim, or finally in rendering the population immune. This does not mean that we have a hopeless problem, nor that efforts toward gaining further definite and practical data along these lines, should be in the least diminished. However in addition to making use of any valuable findings which may appear from time to time, it behooves the follower of preventive medicine to adopt a plan of action, which while it may be far from perfect, is nevertheless by reasoning and practice, effective to some extent, and productive of the best results so far obtainable. This measure is isolation, which attacks the

the spread of the disease in its transmission stage, that is, prevents the passage of the infection from person to person. We are concerned in pneumonia as much if not more than in most communicable diseases, with human carriers, and isolation if it accomplished nothing more useful than preventing the production of carriers, would be an indispensable weapon in the hands of Health Authorities. That it does this and even more, will appear in the following pages.

Isolation when employed effects many people, and in studying its application, we shall consider them in the order of patient, immediate contacts and remote contacts.

In so far as the patient himself is concerned, that is, from the clinical side rather than the Public Health, there is no doubt that isolation is almost imperative. In pneumonia as well as other acute respiratory infections, the patient's chances are diminished by complications, and there is no surer method of protecting him from these secondary invasions than by eliminating as far as possible all contact with humans. Each pneumonia is the result of a Type invasion, and each case is endangered by association with every other pneumonia except those resulting from the same Type. This means that even in Hospital cases must be typed and only those treated in the same room or ward, which are victims of the same Type. Furthermore a patient entering the convalescent stage may become infected by a case or carrier of a different Type, and suffer a socalled relapse. It is well here to emphasize the importance of limiting the

activities of secondary invaders. The data collected in the Army Camps during the War, have shown for example, that streptococcus hemolyticus appeared first as a complication in acute respiratory infections, but later was able, probably through gradually increasing virulence, to initiate its own primary pneumonias which were widespread in distributation.

In dealing with the Public's welfare there likewise is little doubt that isolation of the case is productive of great assistance in limiting the spread. According to the work of Avery, Chickering, Cole and Dochez (14) in a study of 454 cases of pneumonia, the causative organism was Types 1 or 11, in 64%. In other words two thirds of the cases were caused by these Types. In a survey of 297 normal throatsType 1 was found once and Type 11 not at all. A study of 160 individuals who had been in contact with Type 1 patients showed 13% harboring that organism, while in 149 healthy contacts with Type 11 cases 12% were positive for Type 11. From these observations it is apparent 1) that practically two thirds of all the pneumonias are caused by Types 1 and 11, 2) that these same Types are rarely found in healthy individuals other than those associated with the disease, and 3) that more than 10% of normal persons who come in contact with these pneumonia Types become carriers. When it is noted further (15) that Types 1 and 11 are responsible for approximately 62% of all pneumonia fatalities, we naturally conclude that any measure effective in controlling the spread of these Types must have a decidedly benificial effect in lowering the

incidence of the disease as well as the death rate. As noted above, normal individuals other than contacts practically never harbor Types I and II in their throats; the simplest measure then for limiting the spread of pneumonia caused by these Types and this means two thirds of all pneumonias, is by removing the opportunity for contact between public and patient, or in other words, isolating him.

It follows therefore that in so far as the patient himself is concerned, and the general public, isolation is a most desirable step in the control of the disease.

The next consideration is the contact, not the one originating after the patient has been isolated, for here theoretically at least, we expect no contacts, but those resulting from exposure during the week or so preceding the victim's taking to his bed. Here we must be practical and reasonable. A wholesale isolation of all persons with whom he has been intimately associated at home, in streetcars, at work, in crowds, etc., is not only impossible but ridiculous. In the first place there would be no means of locating and identifying the contacts, secondly no way to enforce your isolation, and thirdly presuming the preceding to be possible, you would soon have the entire community affected, and some individuals such as conductors and clerks would spend most of the pneumonia season in isolation.

There is however a practical and sane solution of the problem, which while not available at the present time, bids fair to become so in the near future, namely a more extensive use of the

laboratory. To begin with the patient is isolated and the Type of pneumococcus causing his infection ascertained; at the same time members of the family are cultured, and all showing pneumococci in their throats similar to the patient's are isolated; in the mean time the close associates of the case in shop, store or office, are surveyed and those harboring the same type as the case, should it be I or II, are confined to their homes. This will necessitate at most the examination of perhaps ten or twelve persons, and the isolation of two or three for a short period of time.

It will be argued that this will take at least three days perhaps more, and in the meantime the positives have been spreading the bacteria beyond all possible means of control. Be that as it may, the fact that they are isolated even as late as three days after contact, insures the prevention of spread to a great many, and what is more important, if they should fall victims to the invader, there will be fewer if any contacts resulting from their infection and the Public Health Official will experience a decided relief from work and worry.

We have here suggested a simple method of dealing with immediate contacts, where the disease is the result of invasion by TypesI or II, but there are other people associated with the transmission of disease, whom we must consider, namely the remote contacts. This group would include all those individuals associated with the patient during his incubation period, by other than close contact, for example living in the same building,

working in the same shop etc,. Obviously as stated above with reference to immediate contacts, it is absurd to consider isolating all these individuals, or even making a throat survey to detect carriers. The demands of commerce, public utilities and the peoples' convenience would never consent to such methods except in the presence of a serious epidemic. Such measures are applicable only under military conditions, where all the men in in a squad room or barrackscan be detained, or in large construction camps, where numbers are housed in one bunkhouse. However there is considerable doubt as to the usefulness of isolating remote contacts even when practicable. The pneumococcus is not a hardy micro-organism and requires very favorable conditions to survive long outside of the body. It is doubtful if it can be conveyed further than to close contacts, say those near enough to inhale the spray ejected while talking, coughing or sneezing, a possible distance of six or eight feet. The attempt then to consider those who were no nearer to the patient than being under the same roof, is an expenditure of time and energy not worth the effort, and can have at best but little bearing in limiting the spread of the disease.

Granting then that isolation of the pneumonia cases Types I and II and of immediate contacts who prove to be carriers of the same, is desirable and of practical value in controlling the infection, there are still several important questions which must be considered, chief among them being where to isolate the individuals affected. There is no denying the old

saying, " What is worth doing at all, is worth doing well." and theoretically if we are to enforce isolation it should be accomplished by removing the victims to a place especially adapted for the purpose. This might be an Isolation Hospital, or a General Hospital with facilities for taking care of communicable diseases. Here we should expect ample and competent nursing, an efficient laboratory, and daily nose and throat cultures to detect and remove at once, any attendants harboring dangerous micro-organisms. However few communities are prepared to support a strictly isolation Hospital, with sufficient capacity to care for pneumonias in addition to the diseases already demanding this measure. It would seem almost imperative though, that every large city should have sufficient bed space to care for the pneumonias occuring in the districts where crowding is common, and living conditions are highly unsanitary.

Among the better classes where rooms are not at a premium, we may have to be content with isolating the patient or positive contact at home, confining him to a single room. Here we may have a well trained, a practical or an inexperienced nurse, and the patient is endangered by contact direct or indirect, with members of the household, pets, visitors and neighbors, and they in turn are liable to contract the disease or become carriers and spread the infection in public.

If with present day limitations it is not possible to remove cases to a Hospital, isolation at home is the only alternative. By instructing patient, attendant and family, em-

phasizing the danger to themselves and their friends of any contact with the patient, or with material contaminated by his discharges, there will be enough co-operation to warrant us in expecting fairly satisfactory results, in protecting the Public from the disease. In addition to this, throat cultures of the household should be made at least twice a week, in order to detect and remove dangerous carriers. It might be advisable also to placard the house in the hope that most of the visiting impelled by curiosity would be prevented.

Another important question affecting both the party confined and the Health Officer, is the duration of isolation. Naturally there is no reason for detaining the convalescent or carrier, after the particular organism concerned is no longer present in the sputum or in the cultures from nose and throat. According to Avery, Chickering et al (16) Types I and II pneumonias harbor the bacteria from one to four weeks after date of onset. The date then for releasing such cases might be arbitrarily set as four weeks from day of initial chill. As the patient will not be in physical condition for much activity before that time, the length of the confinement should not call forth much objection. Carriers of these Types have been shown by the same workers to be positive for a period similar to that of convalescents. It would not be practical, though highly desirable to isolate such healthy individuals until no longer a menace. As a working basis one week might be taken as sufficient, and if at the end of this time the party has not contracted the disease

and cultures are still positive, he may be released, but should be informed that he is a serious danger to the community, and must be particularily careful to collect all discharges from his nose and throat in handkerchiefs.

A further aid in rendering both convalescents and carriers innocuous is suggested by the recent work of Bloomfield (17) with carriers of Friedlander's bacillus. He was able to show that the breeding place was a definite focus, the tonsil, and concludes that the carrier state in this instance depends on a focus of diseased tissue. By analogy the same might be suspected of the pneumococcus, and tonsillectomy recommended in the endeavor to clear up recovered patients and carriers. This measure is worth considering where examination shows hypertrophied tonsils with crypts, and could well be applied during the period of isolation.

The carrying out of the above procedures seems simple enough on paper, but in actual practice necessitates many conditions which as yet exist in but few Health Departments. First of all, there must be efficient and rigid reporting of pneumonia cases, with severe penalities for the physcian failing in this respect. Reporting is obligatory in some cities at present, but unfortunately the mortality rate in many almost equals the incidence as judged by reported cases. Secondly, it is essential to have a thoroughly equipped laboratory, with technicians trained in pneumococcus work. Lastly and of equal importance with the preceding, there must be developed a system of stimulating and

instructing the practioner, and of educating the public. Every opportunity should be used to impress the laity with the danger of contact with a case of pneumonia, and the ease with which the contagion is spread by means of carriers. Unless the physcians are induced to co-operate, and the people understand to a certain extent the value of our methods, there is little hope of obtaining good results.

Summary and conclusion.

Pneumococci Types I and II are responsible for approximately 65% of all pneumonias, and for two thirds of the mortality resulting from the disease.

The spread of these infections is probably due more to healthy carriers produced by close contact with cases, than to the cases themselves.

The method by which the bacteria pass from person to person is not definitely known, but presumably requires close association.

There is as yet no simple method by which we can successfully attack the micro-organisms themselves, interrupt their passage between individuals, or render humanity immune.

Therefore if as shown, we can prevent by isolation of patient and immediate contacts, the infecting of others and the production of carriers, in 65% of all pneumonias, that measure is of decided value in limiting the dissemination of the disease.

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